During the initial two boot stages, the computer system BIOS software stored in non-volatile BIOS memory 124 is copied into main memory 125 so that it can be executed more quickly. This technique is referred to as "shadowing" or "shadow RAM" as discussed above. At this time, system management mode ("SMM") code 150 is copied into the system management mode memory area 126 of main memory 125. Processor 105 executes SMM code 150 after processor 105 receives a system management interrupt ("SMI") which causes the microprocessor to enter SMM. Additional conditions under which an SMI is generated are discussed subsequently. It is noted that along with SMM code 150, also stored in BIOS memory 124 and copied into main memory 125 at power up are system BIOS 155 (including a power on self test module-POST), CD-ROM BIOS 157 and video BIOS 160. It will be recognized by those of ordinary skill in the art that other memory mapping schemes may be used. For example, SMM code 150 may be stored in fast SRAM memory (not shown) coupled to the local/processor bus 120.

The system BIOS 155 includes BIOS software for a boot device with removable media, e.g., CD-ROM BIOS 157 software configurable to boot load a CD-ROM 182 of the computer system, in accordance with the El Torito specification as described in further detail below.

In one embodiment, computer system 100 may be a server. The computer system 100 may be configured as a server to manage network resources. As is well known, several types of server configurations may be possible. For example, the computer system may be set up as a file server dedicated to storing files. Any user on the network may store files on the server. Other examples of servers include a print server, a web server and a database server. One example of a computer system 100 in a server configuration is the PowerEdge™ 6400 server manufactured by Dell Computer Corporation.

In one embodiment, the computer system 100 includes a computer-readable medium having a computer program or computer system 100 software accessible therefrom, the computer program including instructions for performing the method of enabling removal of a removable medium of a boot device included in a computer system when booting an embedded operating system. The computer-readable medium may typically include any of the following: a magnetic storage medium, including disk and tape storage medium; an

optical storage medium, including compact disks such as CD-ROM, CD-RW, and DVD; a non-volatile memory storage medium; a volatile memory storage medium; and data transmission or communications medium including packets of electronic data, and electromagnetic or fiber optic waves modulated in accordance with the instructions.

Referring to FIG. 2A, a flow chart shows an embodiment of a method of enabling removal of a removable medium of a boot device included in a computer system when booting an embedded operating system, for use with a computer system 100 illustrated in FIG. 1. The method 200 may be practiced using manual techniques by entering commands to the computer system 100. Alternatively, the method 200 may be practiced through an executable program code such as through the operation of a command file or through the execution of any suitable programming code. In other embodiments, the method 200 may be performed by downloading or transferring of information and commands over a network such as an Ethernet 190 or other communication link.

The method 200 is particularly advantageous as applied in the Build-to-Order business method such as that practiced by Dell Computer Corporation. The personal computer business is rapidly moving toward "build-to-order" manufacturing. The customer typically enters a purchase order for a computer system by selecting specific options such as processor model/speed, memory size, hard disk size, peripheral devices such as CRT monitor size, resolution, keyboard, CD-RW, DVD, printers and others. The computer system purchase order usually includes the choice for a preferred operating system such as Windows ME™, Windows NT™, Windows 2000™ or in some cases Linux. The computer system manufacturer assembles the computer system hardware in compliance with the purchase order.

To load the selected operating system onto the hard disk 180 for the first time, the PC manufacturer typically uses a boot device to initially boot up the computer system 100. A boot device may typically include a floppy disk 185 or a CD-ROM 182. The PC manufacturer typically generates a bootable CD-ROM. The method 200 enables the bootable CD-ROM volume to be unlocked when booting in order to install the customers preferred operating system. The preferred operating system is typically available on another CD-ROM which is different than the bootable CD-ROM, e.g., it is on a second CD-ROM.

The method 200 advantageously provides flexibility to the manufacturing process by enabling customized configurations for each PC order. The PC manufacturer typically ships the custom manufactured computer system with the preferred operating system within a few days to the customer after receipt of purchase order. Typically, a PC manufacturer may ship several thousand "build-to-order" computer systems every day.

A software program, e.g., a custom device driver, is executable by the computer system 100 to enable swapping of the CD media when the computer system 100 is booted from a CD-ROM 182. The CD-ROM 182 is compliant with the El Torito specification and is configured to emulate a hard disk. In one embodiment, the software program may be written in traditional programming languages such as C. In another embodiment, the software program may be implemented using an object oriented programming language such as C++. The boot device driver program is installed into the boot image that is written to the CD boot sector. An embedded image of a boot operating system, along with the device driver program, is saved on the boot sector of CD-ROM 182. The boot operating system may also be referred to as an embedded operating system. Examples of boot operating system preferably include 32-bit operating systems such as Microsoft Windows NT™, Windows 2000™, Windows XP, and Linux. The ISO 9660 track of the boot CD is not required or used by the software program.

In step 220, the computer system 100 is booted with the boot media, e.g., CD media. The booting process loads and executes the boot operating system. Since the boot operating system is CD media based, the backing store memory is the CD media. The CD media is therefore normally locked to avoid memory page faults.

The process of loading and executing the boot operating system includes a system loader, e.g., Windows NT loader or a Linux loader, loading and executing a kernel, a hardware abstraction layer, and drivers included in the embedded image. The boot operating system kernel, hardware abstraction layer and drivers, including the boot device driver program, are loaded from the CD media into non-paged memory of the computer system 100. The boot device driver program is automatically loaded and executed by the kernel of the boot operating system stored in the non-paged memory.